CEC Sponsored Power Quality Projects

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Overview

- Public Interest Energy Research (PIER) Program
- Active and Upcoming Projects
  - Assessing the Energy Efficiency of Selected Power Quality Solutions
  - Evaluation and Demonstration of Emerging Technologies

PIER Industry, Agriculture & Water Program

MISSION

Facilitate technology development and deployment for cost effective energy efficiency, power quality, reliability, availability and energy load reduction solutions for industrial facilities and processes, agricultural operations, and water and wastewater treatment facilities

PIER RD&D for Industry, Agriculture & Water

STRATEGY

- Research must be responsive to the industry needs.
- Leverage experience, skills & resources of other organizations with the same goals.
- Focus on the largest energy users and segments critical to California's economy.

Active and Upcoming Projects

- Assessing the Energy Efficiency of Selected Power Quality Solutions
  - 3rd Harmonics Mitigation
  - Increasing the Efficiency of Adjustable-Speed Drives
  - Three-Phase Active Harmonics Cancellation Technology
- Demonstrate Ultracapacitor Based Dynamic Stabilizer
- Energy Storage RFP

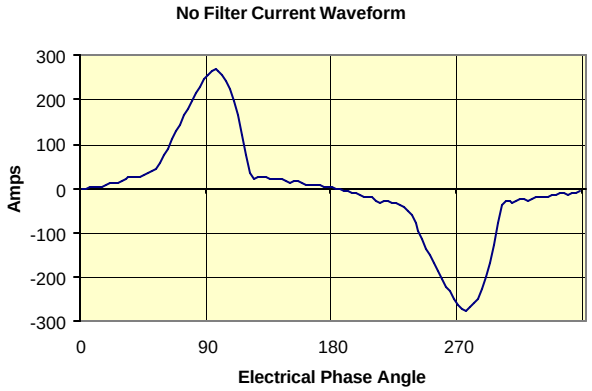
Assessing the Energy Efficiency of Harmonics Mitigation Equipment

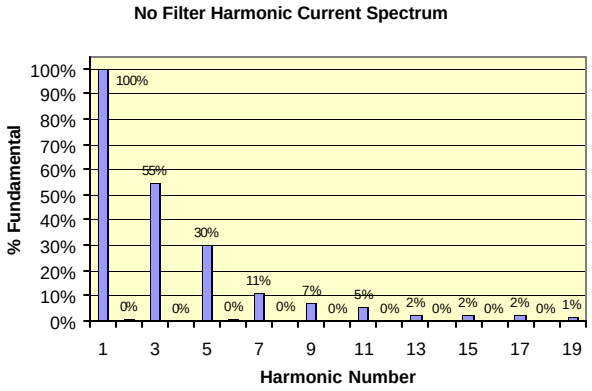
- **CEC interested in measuring and estimating the actual energy savings provided by installing emerging technologies that reduce harmonics currents**
- **Programs are being established to collect actual laboratory measurements and field level data to determine:**
  - **The amount of harmonic currents before and after the installation of the emerging technology**
  - **The actual energy efficiency economic benefits and payback of applying emerging technology**
- **CEC will develop technology application tools to assist end users in applying new technology solutions**

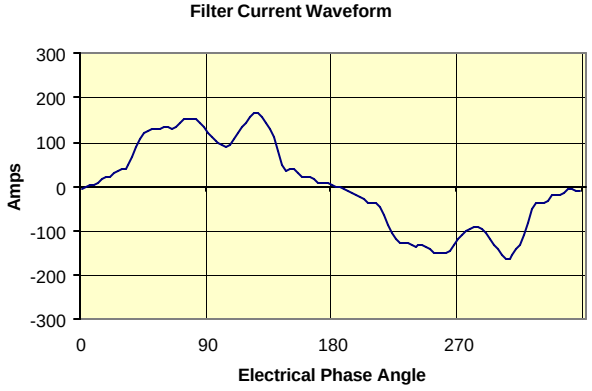
Heat = I^2R

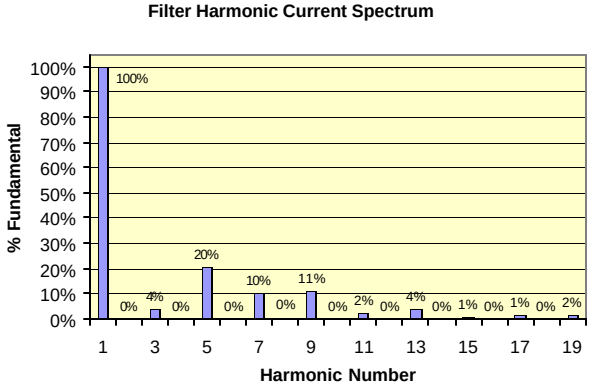
- Wasted energy due to harmonics occurs when harmonic current flows through the resistance of facility wiring
- Additional waste heat can result in transformers and other power equipment
- Estimates of these potential savings vary widely, from less than 1% to as much as 30%

3rd Harmonics Mitigation Equipment



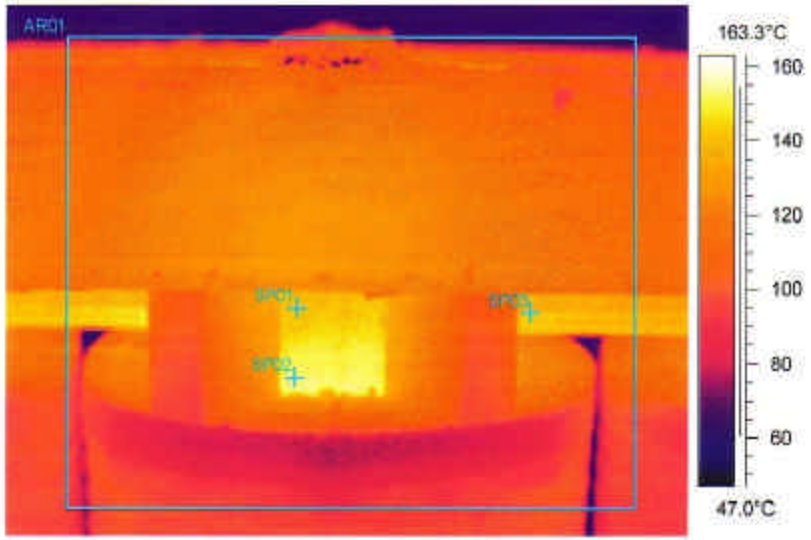




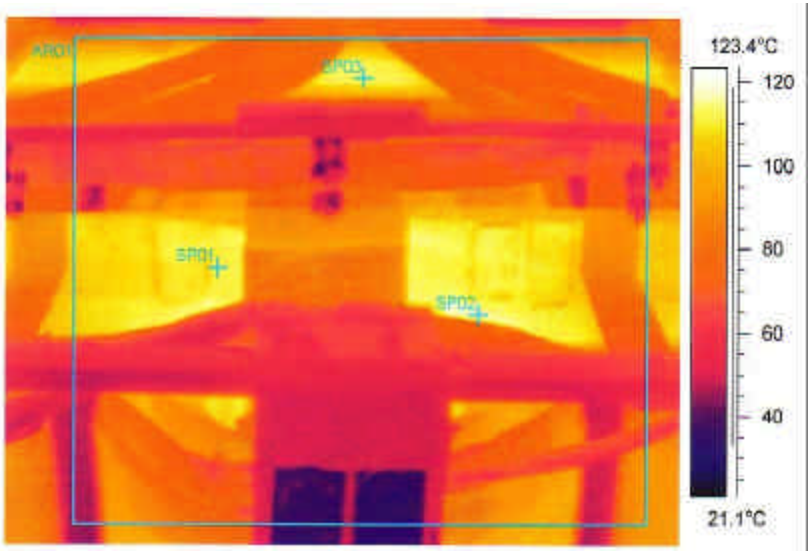


3rd Harmonics Mitigation Equipment Temperature Testing

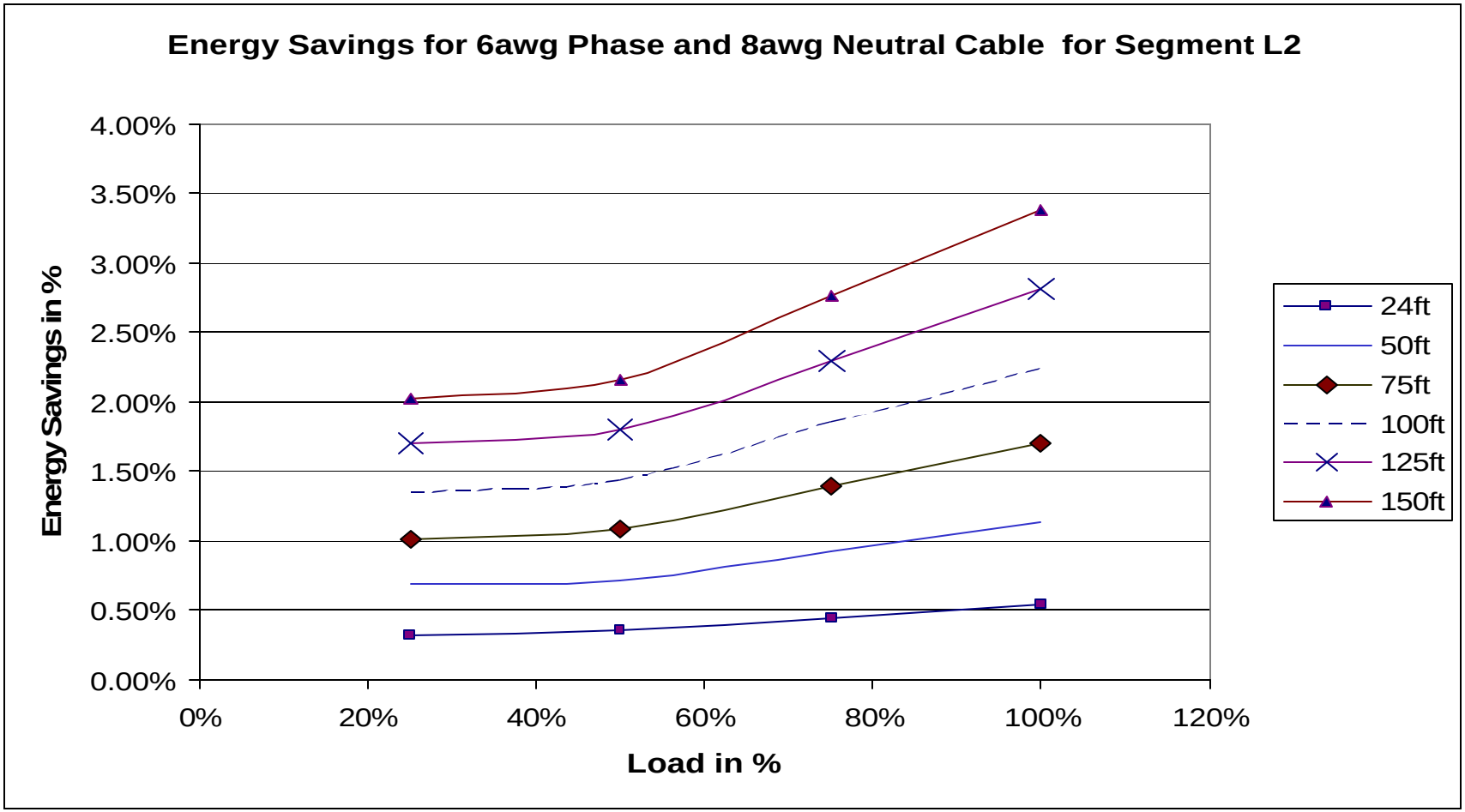
Core, without HSS
Tmax = 155°C



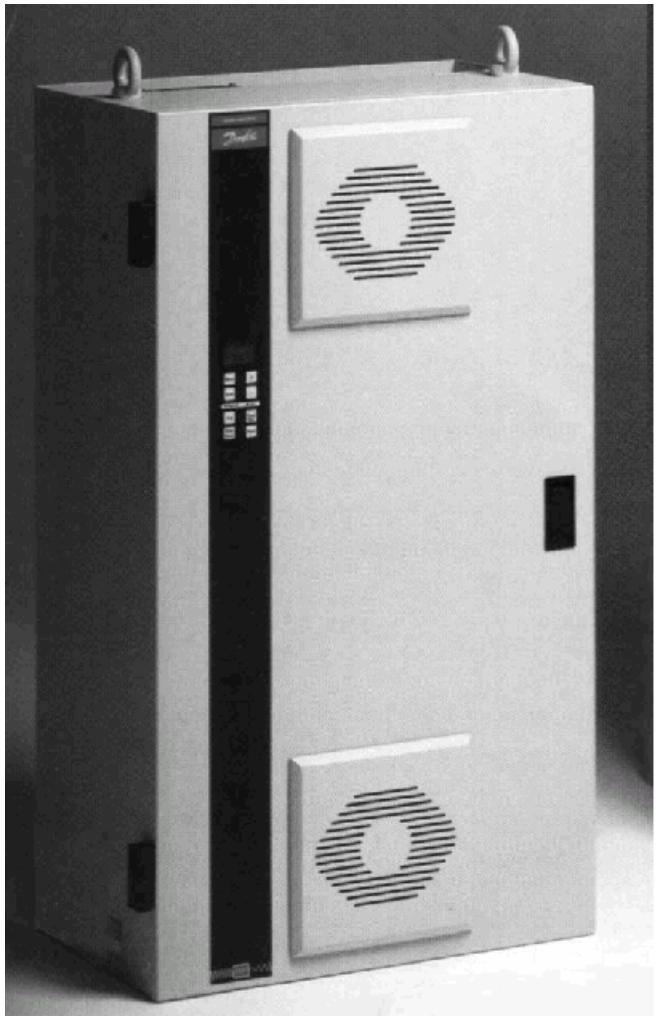
Core, with HSS
Tmax = 119°C



Energy Savings vs. Load

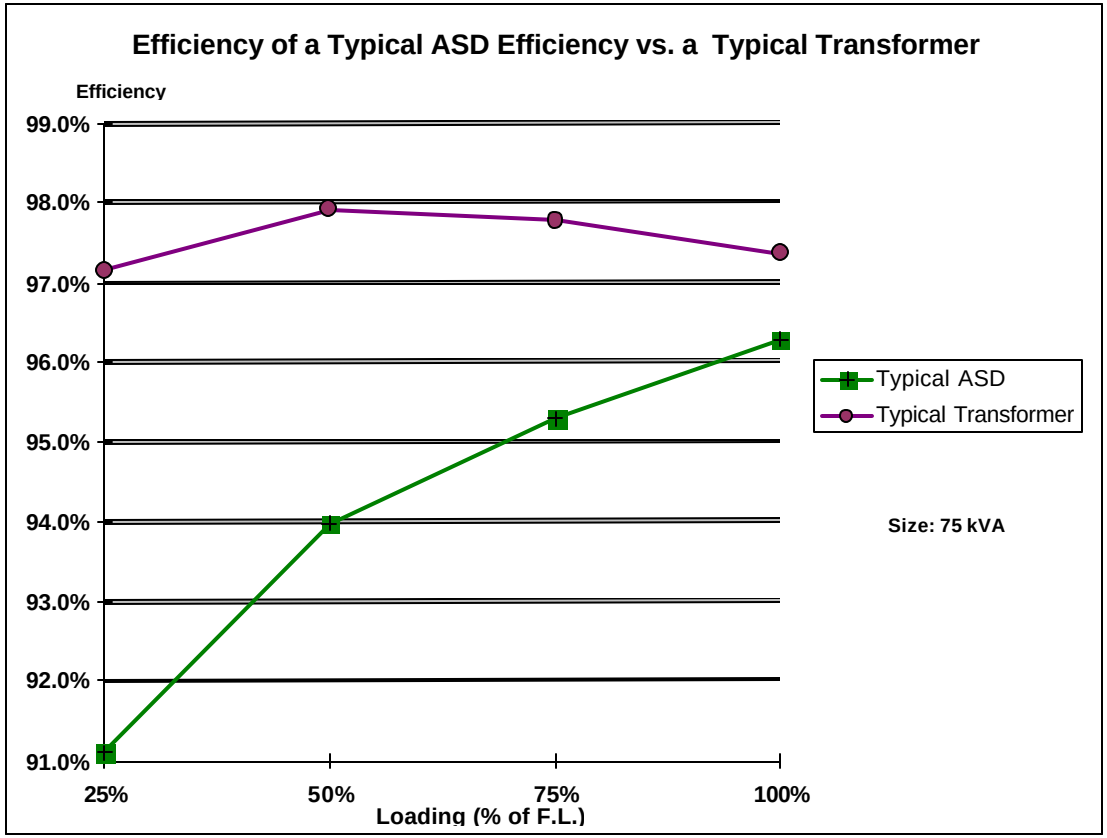


Optimizing Energy Savings with Adjustable-Speed Drives



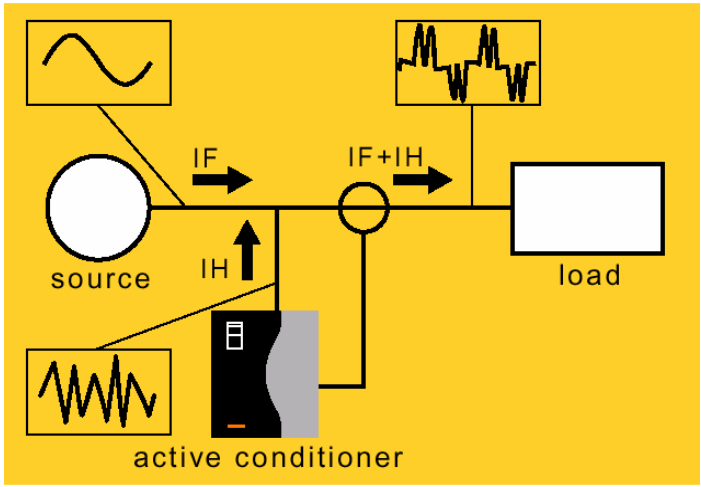
- ASDs are electronics that bring adjustable speed to otherwise single-speed motors
- ASDs enable energy savings at the load due to optimized speed vs. throttling, idling, or bypassing
- However, ASD systems themselves add their own losses, representing an opportunity to improve efficiency by several percentage points

Opportunities for Saving Energy: Identify the most efficient ASDs



- As a Benchmark, typical ASDs are as much as 6% less efficient than typical transformers
- Additional losses in the Motor may amount to 2-5% more in losses
- Which ASD models are the most efficient and why?

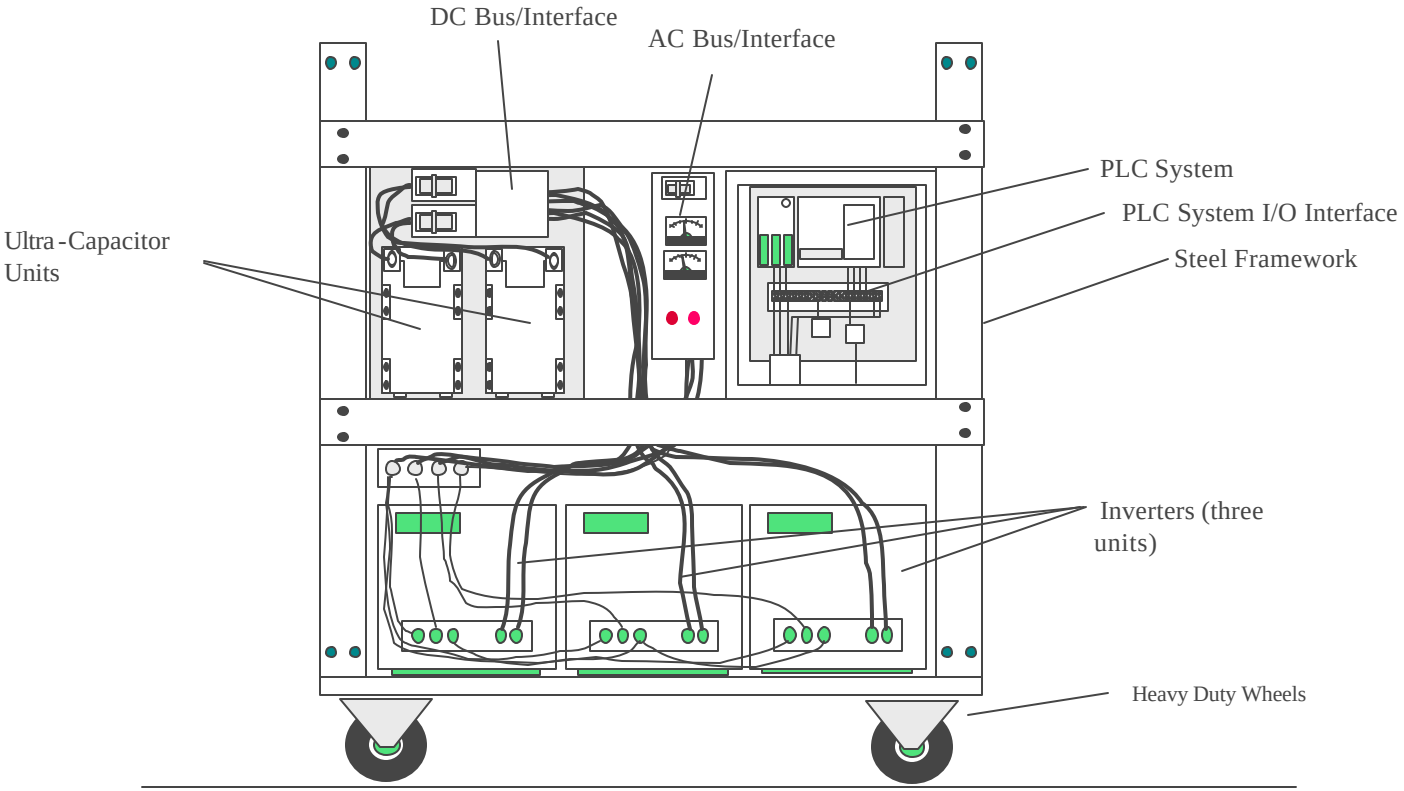
Saving Energy with Active Harmonics Cancellation



- Active Harmonics filters are very similar to ASDs in architecture
- Extra harmonic current drawn by the load is cancelled by the Active Filter, thereby reducing current upstream

Ultracapacitor Based Dynamic Stabilizer

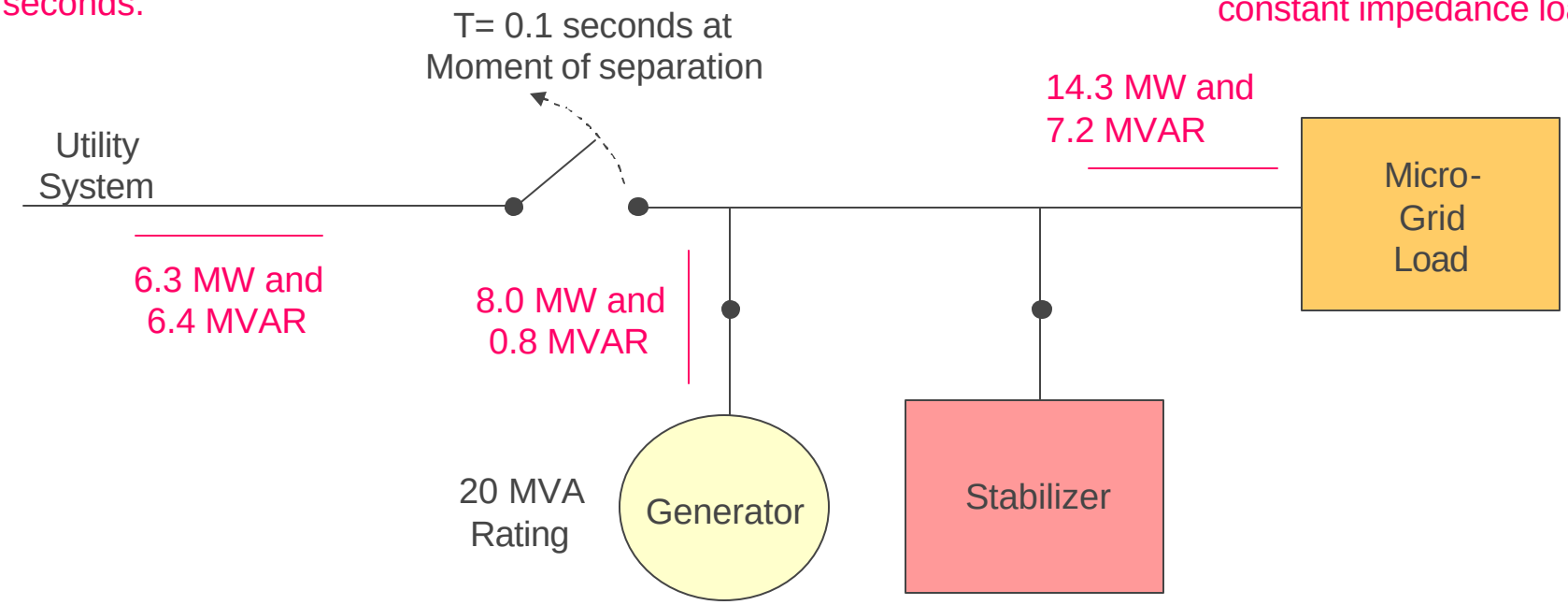
NOTE: Preliminary Design (Still Under Review)



Configuration for Simulations of Dynamic Stabilizer

Note: Real and reactive powers shown are just before the switch opens at t=0.1 seconds.

Load consists of a mix of induction motor load and constant impedance load



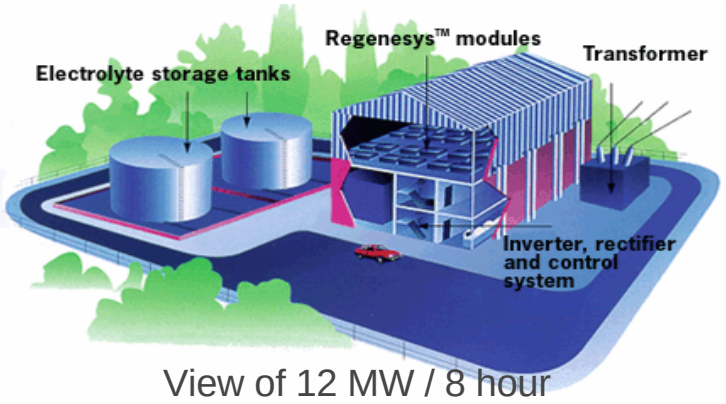
Energy Storage Demonstration RFP

Energy Commission and DOE hosted an Information Exchange Workshop on February 13, 2003 to discuss the current state of energy storage technologies

Active DOE Energy Storage Demonstration Sites

20 MW / 14 MWhr Puerto Rico

6 MW / 8hrs
Sodium-Sulfur at Ohito



View of 12 MW / 8 hour Flow Battery Facility

10 MW - 15 sec System at Microchip Plant

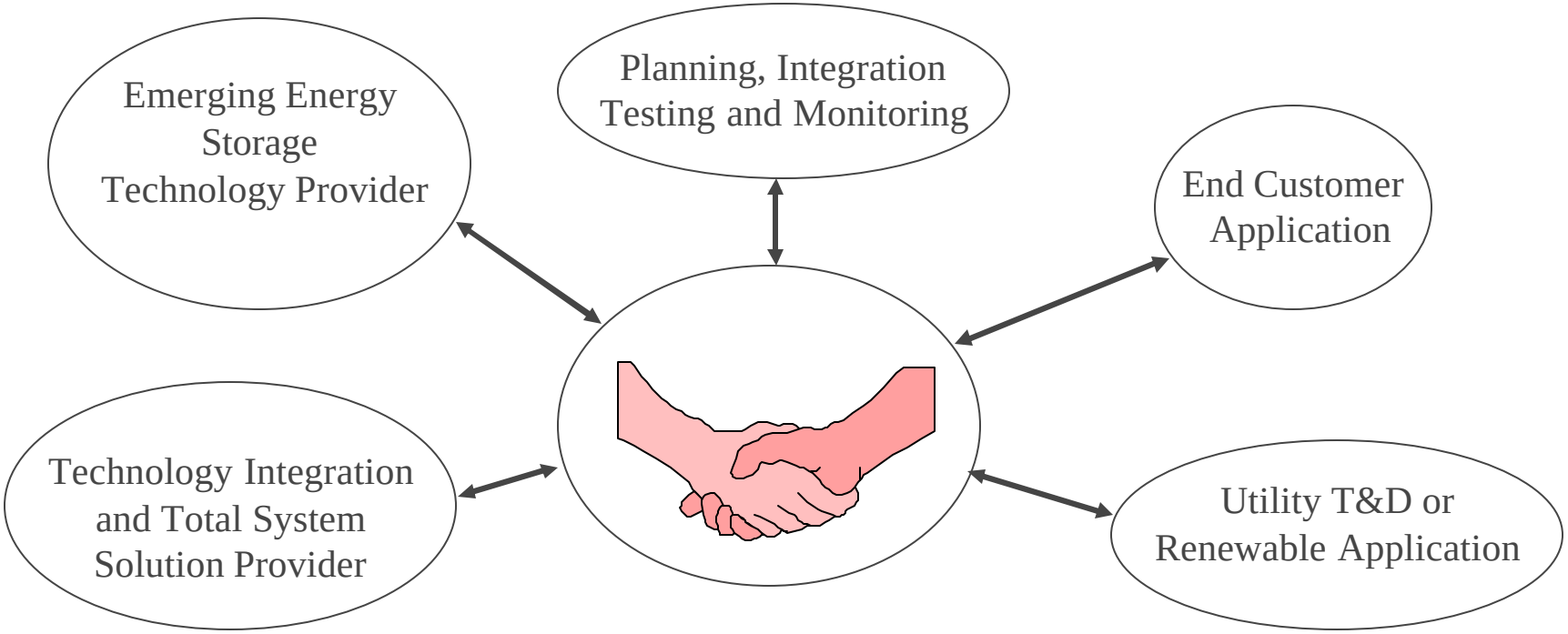
Energy Storage Demonstration RFP

- Program is a collaboration of the California Energy Commission and the U.S. Department of Energy.
- There will be assistance from DOE in the development of solicitation document, project selection, contract management and monitoring.
- Most of the funds would come from the Energy Commission's PIER program.

RFP Applications

- Electricity Storage Applications that deliver tangible, well defined economic value to host site or customer.
- Applications that can be repeated several times within California and nationally.
- Those that have been demonstrated at a pilot scale and are beyond the “proof-of-concept”.
- Examples of possible applications are provided in the next presentation.

Project Teams Must Provide Turnkey Solutions



Successful Turnkey Demonstration Project

Questions ???